

Other scalar and vector quantities

ASHPHYS · REVISION CHEAT SHEET

AS Level

9702 AS Ch.1

Chapter 1: Kinematics

Lesson 1.8

Sections 1.8

Goal: Classify common quantities as scalars or vectors, and explain why.

01 The big picture

A quantity is a vector if its direction matters and it adds like a vector (tip to tail). Otherwise it is a scalar, and scalars add as ordinary numbers.

Multiplying a vector by a scalar gives a vector in the same direction: weight $W = mg$ and momentum $p = mv$ are vectors because g and v are.

Scalars [paraphrase]

distance, speed, time, mass, energy (including kinetic and potential), power, temperature, density, pressure, charge, current.

Vectors [paraphrase]

displacement, velocity, acceleration, force (including weight), momentum, electric and gravitational field strength.

02 Key equations

Weight: scalar $\times$ vector

$$\vec{W} = m\vec{g}$$

Momentum: scalar $\times$ vector

$$\vec{p} = m\vec{v}$$

Symbols and units

m mass (scalar) kg $\vec{g}$ acceleration of free fall (vector) m s^{-2} $\vec{v}$ velocity (vector) m s^{-1}

03 Sample problems with solutions

Sample 1 · Mass and weight

Explain why weight is a vector but mass is a scalar.

Step 1. Weight is a force: the gravitational pull on an object, which acts in a direction (downwards, towards the centre of the Earth).

Step 2. Mass is the amount of matter; it has size only and is the same whichever way the object faces or moves.

Answer: Weight (a force) has a direction; mass has size only.

04 Practice problems

P1 Is kinetic energy a scalar or a vector?

Answer: Scalar

P2 Is momentum a scalar or a vector?

Answer: Vector

P3 Pressure is force $\div$ area. Is it a scalar or a vector?

Answer: Scalar (it acts equally in all directions in a fluid)

P4 Two masses of 3 kg and 4 kg are joined. What is the total mass?

Answer: 7 kg (scalars add as numbers)

05 Other useful information

Common mistakes

- ✗ **Wrong:** Speed and velocity are the same quantity.
- ✓ **Right:** Speed is a scalar; velocity is a vector.
- ✗ **Wrong:** A negative value means a quantity is a vector.
- ✓ **Right:** Scalars can be negative too (temperature in $^{\circ}\text{C}$, charge).

Exam tips

- Ask: does it make sense to say which way it points? If yes, it is a vector.

What the syllabus asks

- 9702 topic 1: understand the difference between scalars and vectors and give examples. Coursebook 1.8.

Explore: [Practice questions for this lesson](#)